ARTICLE | OPEN ACCESS

Medical Science

Comparison of the age of cardiovascular diseases among military personnel with other occupational groups

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To Cite:
Alimohamadi Y, Jalilvand H, Sepandi M. Comparison of the age of cardiovascular diseases among military personnel with other occupational groups. *Medical Science* 2024; 28: e71ms3377
doi: https://doi.org/10.54905/disssi.v28i149.e71ms3377

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Peer-Review History
Received: 15 April 2024
Reviewed & Revised: 19/April/2024 to 28/June/2024
Accepted: 02 July 2024
Published: 07 July 2024

Peer-review Method
External peer-review was done through double-blind method.

Medical Science
pISSN 2321–7359; eISSN 2321–7367

ABSTRACT

Introduction: Military personnel, as one of the most essential occupational groups, are at a risk of developing cardiovascular diseases. This study compared military personnel with other occupational groups regarding the age at which they developed cardiovascular diseases and hospitalization due to these diseases. *Methods:* This study was a cross-sectional study. This study was conducted in a selected military cardiac hospital in Tehran. This study was conducted from winter 2011 to winter 2016 and summer 2020 to winter 2023. We used an independent sample T-test, Spearman correlation test, ANOVA, and the Tuky post hoc test to check the relationship between the variables. *Results:* During the study period, 38,773 cardiovascular patients hospitalized in the study hospital were examined. The mean and standard deviation of the age of the patients in general was equal to 63.80 ± 14.51 years. The age of hospitalization in active military cardiac patients was 49.65 ± 10.85 years. The average age of hospitalization due to cardiovascular disease among active military (also retired military) is significantly (p-value= 0.001) lower than that of civilians. *Conclusion:* In this study, we concluded that the average age of heart disease in military personnel, especially active military personnel, is significantly lower than that in civilians. Because the risk factors of prematurely developing cardiovascular diseases among military personnel are not yet clearly known, we recommend conducting research in the field of accurately identifying the risk factors of military personnel suffering from cardiovascular diseases at a younger age.

Keywords: Cardiovascular disease, military, prevention, management of healthcare services, prediction

1. INTRODUCTION

Cardiovascular disease is a general term for diseases of the heart and blood vessels (Jafari-Sejzi et al., 2018). Cardiovascular diseases generally include coronary artery disease, heart failure, heart attack, cardiac arrhythmia, and

cardiomyopathy (Kotecha et al., 2016; Kausar et al., 2016). Cardiovascular diseases are one of the leading causes of non-communicable diseases, with approximately 17.90 million deaths worldwide (Aminde and Veerman, 2016). They are responsible for 31% of deaths worldwide. More than 80% of the burden of cardiovascular diseases is related to developing countries (Derakhshan et al., 2021; Sarrafzadegan and Mohammmadifard, 2019). In Iran, approximately 82% of all deaths are caused by non-communicable diseases. And the cause of 43% of these cases is death due to cardiovascular diseases (Sarrafzadegan and Mohammmadifard, 2019).

Cardiovascular diseases are also among the most essential causes of hospital admissions worldwide (Baghbani-Oskouei et al., 2018). Cardiovascular diseases are multifactorial. Some factors causing cardiovascular diseases are unchangeable, such as age, gender, and genetics, whereas some other factors are changeable. Among these changes, we can mention blood lipid disorders, high blood pressure, type 2 diabetes, smoking, obesity, continuous stress, lack of regular physical activity, improper diet Baghernezhad-Hesary et al., (2020), and air pollution (Sarrafzadegan and Mohammmadifard, 2019; Hayes et al., 2020; Jing et al., 2018). Due to the various risk factors affecting cardiovascular diseases, different occupational and gender groups are at risk of developing cardiovascular diseases (Rang-Amiz et al., 2005). One of the groups at risk of heart disease is military personnel.

Military personnel are generally more physically fit due to exercise and regular checkups. Therefore, there is a perception that military personnel are at a lower risk of chronic diseases such as cardiovascular diseases compared to the rest of society (Reis et al., 2018; Simic et al., 2021). Stress is one of the leading risk factors for cardiovascular diseases (Ataloo, 2017). When a person experiences stress, it can lead to increased heart rate, elevated blood pressure, and changes in blood sugar levels. Suffering from long-term or chronic stress can lead to cardiovascular diseases such as high blood pressure, heart disease and stroke (Steptoe and Kivimäki, 2013; Poorolajal et al., 2020; Nikbakht et al., 2022).

Several investigations have revealed that military service is a challenging profession owing to the nature of the work environment, job competition, and associated risks (Ataloo, 2017). Beyond the presence of stress, other factors can render military personnel highly susceptible to the development of cardiovascular disorders (CVDs) (Dehghani et al., 2018). In addition, military personnel experience an earlier onset of CVDs (Ataloo, 2017). This study was conducted to investigate the age of cardiovascular diseases among military personnel compared with other occupational groups in the military heart hospital of Tehran from 2011 to 2016 and 2020 to 2023 years.

2. METHODS

Type of Study

This study was a cross-sectional study. This study was conducted using the data of patients admitted to the inpatient wards of a selected military heart hospital in Tehran. The data required for this study were extracted from the hospital information system (HIS) of the heart hospital under study.

Study population

The study population included all military and civilian cardiovascular patients admitted to the selected military heart hospital in Tehran. This study was conducted from winter 2011 to winter 2016 and summer 2020 to winter 2023. In this study, we excluded patients with at least one of the following conditions from this study.

The reason for his visit to one of the military heart hospitals in Tehran was a disease other than cardiovascular disease.

Their data was not available or incomplete in one of the military heart hospitals in Tehran's HIS system.

Patients whose type of health insurance was not known.

How to extract data

We extracted the data required for this study from the hospital information system (HIS) in a selected military cardiac hospital in Tehran. At first, we prepared a list of variables. Then the variables related to the study were selected. We removed the variables that had more than 30% missing. In this study, we did not have the occupation of cardiovascular patients. We used the type of health care insurance to determine the occupation of the patients. We used the fields of date and time of admission and discharge (final discharge) to calculate the hospitalization period of cardiovascular patients. We considered the hospitalization period of hospitalized and discharged patients in one day for half a day.

Data analysis method

To report the descriptive results, we used the mean, standard deviation, absolute frequency and absolute frequency percentage indicators. We used independent sample T-test, Spearman correlation test and variance test (ANOVA) together with Tuky post hoc test to check the relationship between study variables (Table 1).

Table 1 Data analysis method

To investigate	We used
The relationship of gender variables with the duration of hospitalization (in days)	Independent sample T-Test
The relationship of the age variable with the duration of hospitalization	Spearman correlation test
The relationship of the age variable with being in the military or not	Independent sample T-Test
The relationship between the length of hospitalization variable and the type of insurance variable (person's job)	Variance test (ANOVA) together with Tuky post hoc test
The relationship between the age of hospitalization variable and being in the military or not	Independent sample T-Test
The relationship between the age variable and the insurance type variable (person's occupation)	Variance test (ANOVA) with Tukey post hoc test
The relationship between the season variable and age and duration of hospitalization	Variance test (ANOVA) along with Tukey's post hoc test

We used SPSS software version 16 (IBM SPSS version 16) to analyze the data. We performed the analyses at the 0.05 level.

3. RESULTS

During winter 2011 to winter 2016 and summer 2020 to winter 2023, 38,773 cardiovascular patients hospitalized in the study hospital were examined. The highest number of hospitalizations in W 2013 – W 2014 was equal to 6182 hospitalizations (15.94%). The mean and standard deviation of the age of the patients in general was equal to 63.80 ± 14.51 years. The average age among the military (including all employed and retired military personnel, families of employed and retired military personnel, persons in the medical services of the armed forces insurance and conscripts) is equal to 62.60 ± 14.42 years and among the civilian population (all having insurance not related to the military) was equal to 65.36 ± 14.48 years. The mean and standard deviation of the age at hospitalization in active military cardiovascular patients was 49.65 ± 10.85 years (Table 2). 28,206 (72.75%) of the patients had a history of hospitalization for one day and 792 (2.04%) for more than ten days (Table 3).

Table 2 Distribution of demographic data of cardiovascular patients from winter 2011 to winter 2016 and summer 2020 to winter 2023.

Row	Variable	Grouping	Absolute frequency (%)
1	Year	W 2011 – W 2012	5031 (12.98)
		W 2012 – W 2013	6037 (15.57)
		W 2013 – W 2014	6182 (15.94)
		W 2014 – W 2015	5579 (14.39)
		W 2015 – W 2016	6085 (15.69)
		S 2020 – W 2021	1799 (4.64)
		W 2021 – W 2022	2861 (7.38)
		W 2022- W 2023	5199 (13.41)
2	Sex	Male	21864 (56.40)

		Female	16909 (43.60)	
3	Season	Spring	7875 (20.31)	
		Summer	10013 (25.83)	
		Autumn	10474 (27.01)	
		Winter	10411 (26.85)	
4	Age	< 40	2673 (6.89)	
		40-49	2490 (6.42)	
		50-59	8513 (21.95)	
		60-70	12476 (32.17)	
		> 70	12621 (32.55)	
5	Job	According to being military	Military (related to the military)	21818 (56.27)
			Civilian	16955 (43.73)
		By type of job based on health insurance	Active military	1301 (3.36)
			Retired military	3477 (8.97)
			Armed forces medical service insurance	8663 (22.34)
			Armed forces family	6047 (15.60)
			Active and retired soldiers with war-related disabilities	2227 (5.74)
			Conscript	103 (0.26)
			Civilian	16955 (43.73)

Table 3 Distribution of the length of hospitalization of patients by days in the hospital

Row	Hospitalization period (up to date)	Number of patients (%)
1	≤ one	28206 (72.75)
2	Two-five	7199 (18.57)
3	Six-ten	2566 (6.62)
4	11-20	554 (1.43)
5	21-40	83 (0.21)
6	41-60	21 (0.05)
7	61-80	43 (0.11)
8	81-100	20 (0.05)
9	≥ 101	81 (0.21)
Total		38773 (100)

The average and standard deviation of hospitalization of patients in the hospital during the study period, excluding the duration of hospitalization of 2% of patients with hospitalization duration of more than ten days, was equal to 1.63 ± 1.86. The length of hospitalization of cardiovascular patients has a significant relationship with gender ($P < 0.001$). The average length of hospitalization of men (1.74 ± 1.94) was significantly longer than that of women (1.48 ± 1.73). In the investigation of the relationship between the age variable and the duration of hospitalization, it was found that there is a significant positive correlation between these two variables ($P<0.001$ and $r=0.169$), which means that with increasing age, the average duration of hospitalization increases significantly.

In examining the relationship between the duration of hospitalization between being in the military (including active or retired military, families of soldiers, service insurance of the armed forces, and soldiers and veterans) and being a civilian, there was a significant difference between these two groups ($P < 0.001$). The average length of hospitalization among military personnel is significantly higher than that among civilians. A comparison of the length of hospital stay of cardiovascular patients showed that there

is a significant difference between the length of stay of military and civilian patients (P < 0.001). In examining the follow-up test, there was a significant difference between all army or military dependent groups (except conscripts) regarding the length of hospitalization with civilians. The length of hospitalization in conscript patients was not significantly different from civilian patients (Table 4).

Table 4 Examining the relationship between a person's type of job and the length of their hospitalization

Row	Type of job (based on individual health insurance)	Separation	p-value
1	Active military	Retired military	0.171
		Armed forces service insurance	0.001
		Armed forces family	0.002
		Active and retired war-disabled	0.146
		Conscript	0.946
		Civilian	0.001
2	Retired military	Armed forces service insurance	0.001
		Armed forces family	0.524
		Active and retired war-disabled	One
		Conscript	One
		Civilian	0.001
3	Armed forces service insurance	Armed forces family	0.001
		Active and retired war-disabled	0.001
		Conscript	0.003
		Civilian	0.001
4	Armed forces family	Active and retired war-disabled	0.887
		Conscript	One
		Civilian	0.001
5	Active and retired war-disable	Conscript	One
		Civilian	0.001
6	Conscript	Civilian	0.22

In the examination of the relationship between the length of hospitalization between being in the military (including active or retired military, families of soldiers, service insurance of the armed forces, and soldiers and veterans) and being a civilian, there was a significant difference between these two groups (p-value=0.03) and the average age of hospitalization among military personnel was significantly lower than that of civilians. In the follow-up examination, there was a significant difference between all groups regarding hospitalization age. The lowest average age of hospitalization was related to active military patients with a value of 49.65 years (Table 5).

A significant relationship (P<0.001) was observed between the length of hospitalization and season. In the follow-up test, there was a significant difference in the age of hospitalization only between spring and different seasons, and the age of hospitalization was slightly and significantly lower in spring than in different seasons. There was a significant relationship between the age of hospitalization and season (P = 0.006). In the follow-up test, there was a significant difference in the length of hospitalization between spring and autumn (Table 6).

Table 5 Investigating the relationship between a person's type of job and hospitalization age

Row	Type of job (based on individual health insurance)	Separation	p-value
1	Active military	Retired military	0.001
		Armed forces service insurance	0.001
		Armed forces family	0.001
		Active and retired war-disabled	0.001
		Conscript	0.001
		Civilian	0.001
2	Retired military	Armed forces service insurance	0.001
		Armed forces family	0.001
		Active and retired war-disabled	0.001
		Conscript	0.001
		Civilian	0.001
3	Armed forces service insurance	Armed forces family	0.001
		Active and retired war-disabled	0.001
		Conscript	0.001
		Civilian	0.001
4	Armed forces family	Active and retired war-disabled	0.001
		Conscript	0.001
		Civilian	0.001
5	Active and retired war-disabled	Conscript	0.001
		Civilian	0.001
6	Conscript	Civilian	0.001

Table 6 Investigating the relationship between age and length of hospitalization with season

Variable	Season	Separation	p-value	Variable	Season	Separation	p-value
Age	Spring	Summer	0.001	Length of hospitalization	Spring	Summer	0.075
		Autumn	0.001			Autumn	0.034
		Winter	0.001			Winter	0.986
	Summer	Autumn	0.998		Summer	Autumn	0.991
		Winter	0.214			Winter	0.116
	Autumn	Winter	0.144		Autumn	Winter	0.052

4. DISCUSSION

The mean and standard deviation of hospitalization age in active military cardiac patients was 49.65 ± 10.85 years. The average age of hospitalization in active military cardiovascular patients is significantly less compared to inactive military cardiovascular patients, retired and civilian cardiovascular patients. Radoje Simic and colleagues noted in 2021 that although military personnel are generally more physically active and have regular physical examinations. It is believed that military personnel are at a lower risk of cardiovascular diseases. However, research results have reported that 13% of US military personnel have cardiovascular disease (Simic et al., 2021). Ataloo, (2017) study also mentions that the military ranks first among the most stressful jobs. In addition, the age of cardiovascular disease in military personnel and their family members is lower than that in the civilian population.

Military jobs are stressful jobs. High stress in military jobs increases the risk of cardiovascular diseases in military patients (Simic et al., 2021). Cardiovascular diseases are one of the most essential diseases in military personnel and require immediate treatment and

planning for efficient management (Parsons et al., 2015). Cardiovascular diseases reduce efficiency in work environments. In cardiovascular patients, increasing the desire to receive care reduces the efficiency of the patients. And this increases the costs of the organization that employs this person (Pakdaman et al., 2020). Increasing the defense capability of military forces is one of the constant concerns in all countries. The degree of political, economic, and cultural independence in all countries depends on the ability and efficiency of the military forces. To maintain the country's military strength, military personnel must have good physical and mental health. It is necessary to know the factors that lead to a decrease in the health of soldiers.

Conducting studies to improve the health of military personnel and their families is of particular importance (Ataloo, 2017). In all countries of the world, health and medical authorities improve guidelines and services for the diagnosis and treatment of cardiovascular diseases in military personnel and family members. Improving diagnosis and treatment services in cardiovascular diseases prevents hospitalization of these patients and reduces treatment costs (Reis et al., 2018). Another study reported that there are significant gaps in the literature regarding cardiovascular disease risk assessment in military personnel, particularly those deployed in combat environments. Future research in the field of cardiovascular diseases should be aimed at evaluating risk factors in military personnel and identifying the relationship between stress in military jobs (McGraw et al., 2008). Military authorities should investigate the state of cardiovascular diseases among the military and identify the risk factors of cardiovascular diseases (Mirzaeipour et al., 2019).

Improving the working condition and health condition of military personnel has a fundamental and continuous effect on the health of veterans and soldiers in the future (Bergman et al., 2021). According to the reviewed studies, it can be concluded that military personnel and their families, because they are exposed to higher stress and anxiety than the general society, may be at a higher risk of contracting, hospitalization, and death from cardiovascular diseases. Therefore, examining cardiovascular diseases among military personnel and their families is of great importance. This issue is critical in Iran because the average age of patients with cardiovascular diseases in Iran is lower than the world average. Therefore, we estimate that the age of patients with cardiovascular disease in Iranian soldiers is much lower than the average age of the general population in the world, which requires the special attention of the authorities to prevent and reduce the incidence of cardiovascular diseases among soldiers and their families.

In this study, 21,864 (56.39%) of all hospitalized cardiovascular patients were male. In the study of Ahmadi et al., (2016) 72% of the examined cardiovascular patients were male. In the study of Moaddab et al., (2020) 66% of patients with infarction were male. In the study by Arjenan et al., (2021) and his colleagues, who conducted on the mortality of heart patients, 49.3% (809 cases) were male and 50.7% were female. Darabi et al., (2023) conducted a study in titled "Evaluation and prediction of the risk of cardiovascular disease in women and men in the primary care system: A case study in Ardabil". The results of this study have shown that there is a relatively high prevalence of some risk factors for cardiovascular diseases, including a history of blood pressure, diabetes, abdominal obesity, suffering from lipid disorders, and a body mass index of 30 in women.

In addition, the results of this study have shown that 38.3 men and 61.72% of women are at the risk level of 10-20%, 34.8% of men and 65.2% of women are at the risk level of 20-30% and 28.9 71% of men and 71.1% of women were at risk level above 30% (Darabi et al., 2023). According to the results of this study and previous studies, we concluded that the ratio of male and female patients with heart disease does not differ much. In general, according to previous findings, women are at a higher risk of developing cardiovascular diseases, whereas men are at a higher risk of disease exacerbation, hospitalization, and death due to cardiovascular diseases.

5. CONCLUSION

According to the results of this study, we concluded that the Average age of hospitalization of cardiovascular diseases in active military personnel is lower than that in the families of military personnel and civilians. In this study, we concluded that the average age of admission to the hospital in active military cardiovascular patients is significantly lower than in other groups. The lower hospitalization age of active military cardiovascular patients can indicate the fact that there are factors in the career of military personnel that increase the probability of occurrence and hospitalization of active military personnel with cardiovascular diseases at a younger age. The younger hospitalization age of active military cardiovascular patients indicates the potential risk of cardiovascular diseases in military personnel, especially active military personnel.

This conclusion is also significant considering the high level of stress and the relationship between stress and cardiovascular diseases. This could mean that military personnel could be at risk of developing cardiovascular diseases at a younger age because of

occupational stress. Improving the health of military personnel is one of the most necessary actions in the country. In this study, we did not have the initial history of patients with cardiovascular diseases. Therefore, we recommend that comprehensive studies be conducted on the causes of cardiovascular diseases among military personnel at a younger age, so that soldiers, especially active soldiers, are prevented from suffering from cardiovascular diseases.

Acknowledgments

We thank all the professors and people who helped us conduct this study. We also thank the studied hospital for cooperating in this study.

Author Contributions

SM and AY suggested the study idea. AY designed this study. JH provided, collected, and checked the data. AY and JH performed the data analysis. JH wrote an early version of the article. All authors participated in revising the text of the manuscript and preparing the final version.

Ethical approval

We conducted this study after obtaining permission from the Research Council and approval from the Ethics Committee of Baqiyatallah University of Medical Sciences with the ethics code IR.BMSU.REC.1401.1401.109 and project code number 401000238.

Informed consent

Not applicable.

Funding

This study has not received any external funding.

Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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